

4. The AD-AS Model and Inflation

EE 212

Case & Fair, ch. 13; LCR, ch. 25-26, 30; Froyen, ch.9

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- ➊ Introduction
- ➋ The Derivation of Aggregate Demand (AD)
- ➌ Aggregate Supply (AS): Classical School, Keynes, Non-Keynes, Non-Keynes and Non-Classics
- ➍ Determination of equilibrium, change in equilibrium, and multipliers
- ➎ The Equilibrium price level and inflation
 - ➊ definition
 - ➋ causes of inflation : Demand-pull inflation, Cost-push inflation

1. Introduction

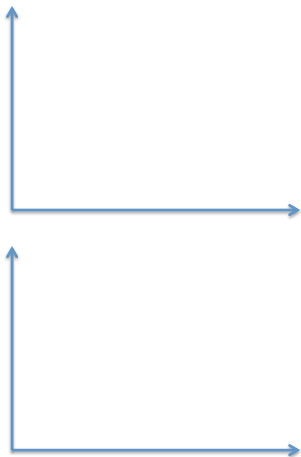
- Chapter 3 : National Income Determination $\Leftarrow$ Demand Side of Economy , keeping the supply side constant (fixed output at full-employment, Y_F)
- Assumptions :
 - ① Constant Price Level
 - ② Fixed Resources and Fixed Technology
- Reality : Price is not constant, the Supply side affects equilibrium national income
- This chapter : study
 - develop Aggregate Demand (AD) Function from DAE model : relationship between price and desired aggregate expenditure
 - develop Aggregate Supply (AS) Function : relationship between price and the level of output firms would like to supply
- Use AD-AS model to analyze the cause of inflation

2. The Derivation of Aggregate Demand (AD)

- Fixed Resources and Fixed Technology
- Δ Price Level $\Rightarrow \Delta$ National Income Y
- Keeping Price Level Constant : $P = P_0$
- Suppose price level $\uparrow$ from P_0 to P_1
 - $\Rightarrow$ Real Wealth (Real Wealth = $\frac{\text{Nominal Wealth}}{\text{Price Level}}$) $\Rightarrow$
 - Consumption
 - $\Rightarrow$ DAE shift $\Rightarrow Y$
- Graphically Illustrate

- Construct the other diagram to show the relationship between the price level and Y_E : Aggregate Demand (AD Curve)

- The relationship between DAE and AD curve



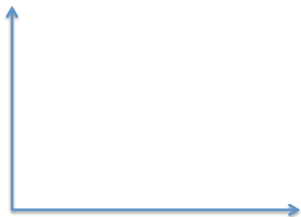
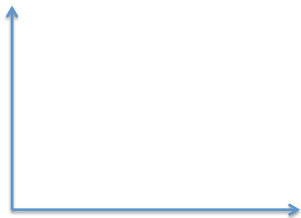
- DAE Model : At P_0

- National income equilibrium is
- Y_1 Y_0 , DAE Y
- Y_2 Y_0 , DAE Y

- AD model : At $P = P_0$

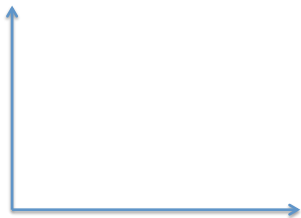
- $Y = Y_0$, the point is on AD line
- $Y = Y_1$, the point is below AD line, $DAE > Y$
- $Y = Y_2$, the point is above AD line, $DAE < Y$
- Every point on AD represents Equilibrium in commodity market

- Effect of a change in autonomous expenditure (Autonomous Expenditure $\uparrow$)



- DAE Model : Price level remains constant, autonomous expenditure $\uparrow$ (for example : $C_0, G_0, I_0, X_0 \uparrow$ or $T_0, M_0 \downarrow$)
 - at P_0 , DAE shift from DAE_0 to DAE_1 and Y_E from Y_{E0} to Y_{E1}
- AD model :
 - at $P = P_0$, $AD = \dots\dots$
 - This is true for all price levels
 - When autonomous expenditure $\uparrow$, other things remain constant, for all price levels, Y_E and AD shift to the

- Effect of a change in autonomous expenditure (Autonomous Expenditure ↓)

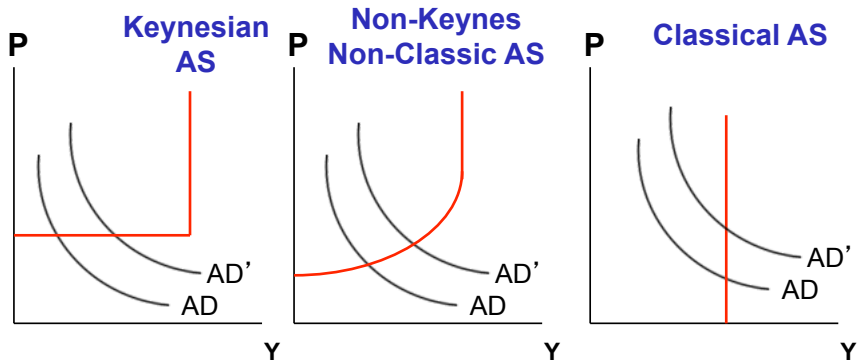


- DAE Model : Price level remains constant, autonomous expenditure ↓ (for example : C_0, G_0, I_0, X_0 ↓ or T_0, M_0 ↑)
 - at P_0 , DAE shift from DAE_0 to DAE_1 and Y_E from Y_{E0} to Y_{E1}
- AD model :
 - at $P = P_0$, $AD = \dots\dots$
 - This is true for all price levels
 - When autonomous expenditure ↓ , other things remain constant, for all price levels, Y_E and AD shift to the

- The movement along the AD curve is caused by change in price level, other things remain constant
- Shift in the AD curve is caused by change in autonomous expenditure.
 - If autonomous expenditure ↓ , AD shift to the
 - If autonomous expenditure ↑ , AD shift to the

3. Aggregate Supply (AS)

- Production Function : $Q = f(K, L)$, where Q is quantity produced, K is capital and L is labour
- AS: three schools of thoughts
 - 1 Classics : Adam Smith
 - 2 Keynes
 - 3 Non-classic, Non Keynes



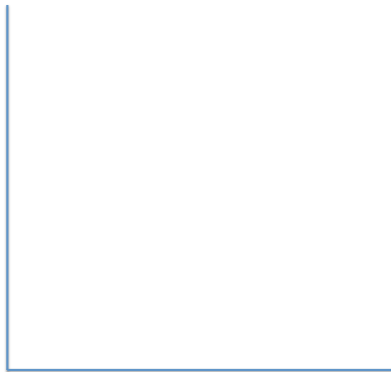
Note : Classical AS is known as Long-Run Aggregate Supply

Classic	Economy operates at full employment Autonomous Expenditure $\uparrow$, AD shift right, $\bar{Y}$, $P \uparrow$
Keynes	Economy operates lower than full employment AD shift right, $\bar{P}$, $Y \uparrow$ (when economy reaches full employment , no distinction between Keynes and Classic)
Non-Keynes, Non-Classic	Economy operates lower than full employment AD shift right, $P \uparrow$, $Y \uparrow$ (when economy reaches full employment there is AD shift right, $\bar{Y}$, $P \uparrow$)

3.1 Classical School

- Assumes that the economy must always operate at full-employment
- Full-employment : always produced at “normal rate of utilization”
- In the short run :
 - ① Fixed Technology
 - ② Factor price is flexible (fully adjusted)
- $Q = f(\bar{K}, L)$: K is constant in the short run
 - $P \uparrow \Rightarrow$ (1) Firms want to produce
 - $\Rightarrow$ (2) Labours want nominal wage $\Rightarrow$ Cost $\uparrow$
 $\Rightarrow$ Firms want to produce
- Factor price is fully adjusted $\Rightarrow$ Real wage is the same
 - $\Rightarrow$ the two effects, (1) and (2), fully offset each other
 - $\Rightarrow$ as $P \uparrow$, nominal wage $\uparrow$, production is the same, firms supply the same level of output

- Graphically Illustration (AS -Classical School)



- Autonomous expenditure $\uparrow$ (ex : C_0, G_0, I_0, X_0or T_0, M_0)
 - AD shift to the,
Keeping nominal wage constant : AS remain the same
 - Equilibrium Price,
Labour would require nominal wage
 - (Classical school believes in perfect market; perfect competition)
 - the cost of production,
AS shift

- Classical school believes in market mechanism or invisible hand of Adam Smith
- Perfect market $\Rightarrow$ Market mechanism brings about the best resource allocation
 - If there is an increase in demand for goods A and a decline in a demand for goods B, resources will flow from the production of goods B to the production of goods A
- All prices will adjust until we reach full-employment
 - When there is an excess demand for factor of production, factor price will rise
 - When there is an excess supply for factor of production, factor price will fall

1. AD-AS Model: Classic

- Autonomous expenditure $\uparrow$
(ex: $C_0, G_0, I_0, X_0 \uparrow$ or $T_0, M_0 \downarrow$)
 $\Rightarrow$ AD shift to
 $\Rightarrow$ Price level , Y
.....
- (This is because when the price $\uparrow \Rightarrow$ excess demand for labour
 $\Rightarrow$ nominal wage $\uparrow \Rightarrow P \uparrow$ and Cost $\uparrow$ produce at the same level)
- There is **no “Multiplier Effect”** , multipliers = 0

2. DAE Model :

- Autonomous expenditure $\uparrow$
 - DAE shift from DAE_1 to DAE_2 (keeping price constant)
 - Producers want to produce more.
 - Since the economy operates at full-employment, labour requires higher wages.
 - Cost and Price
 - Price Real wealth and C_0
 - Since the price is fully adjusted, DAE shift back from DAE_2 to DAE_1

- Recession

- unemployment is high
 - classical school believe that nominal wage will
 - as a result, the firm will hire labour, unemployment, production
 - The recession problem is sloved by market mechanism.
 - There is no need for government intervention.
- Great depression in 1930s : In most countries, recession started in 1930 and lasted until the late 1930s or middle 1940s.
- [Unemployment in the U.S. rose to 25%, and in some countries rose as high as 33%. Stock market crash (Black Monday), Bank failures (Bank Runs)]
- John Meynard Keynes developed Keynesian Model during the great depression; believing that market is imperfect and government action is needed.

3.2 Keynes

- The market is imperfect. Prices are too slow to adjust.
- The economy does not always operate at full-employment.
- During the great depression, if there is no government intervention, stagnation (low economic growth) will last forever. People are too pessimistic about the future. They are reluctant to spend. Aggregate spending (AD) would be too low. The government has to stimulate AD, increasing its spending; i.e. to develop a big civil project to create jobs.
- The government can play an important role stimulating the economy to solve the recession problem.
- Assumption : Fixed Technology, Fixed factor prices

- $Y < Y_F$:

- “Firms operate with excess capacity. Then, they respond to demand variations by altering output while keeping price constant. In other words, they will supply whatever they can sell at their existing prices as long as they are producing below their capacity*”
- By using idle capacity, output can be raised without increasing cost of production and this the price level.
- *Price rigidity (not flexible) : One possible explanation is that changing price frequently is too costly.

- $Y = Y_F$: There is no distinction between Classics and Keynes

- Firms operate at its full capacity. No factors left idle
- When price $\uparrow$, the producer can not produce more since there is no more factor of production that can be used to produce good (all factors of production have already been used to produce good).

- SRAS : Keynes

1. AD-AS Model: Keynes

- $Y < Y_F$
 - Autonomous expenditure $\uparrow$
(ex : $C_0, G_0, I_0, X_0 \uparrow$ or $T_0, M_0 \downarrow$)
 $\Rightarrow$ AD shift to the right
 $\Rightarrow$ Price level remain unchanged , $Y \uparrow$
 - There is “**Multiplier Effect**”.
- $Y > Y_F$, Inflationary gap
 - There must be an adjustment to the price $P \uparrow$.
 - If there is further increase in DAE, inflationary gap will be wider and wider and price will be higher and higher

2. DAE Model : Autonomous expenditure $\uparrow$

- DAE shift to the right from DAE_1 to DAE_2 (keeping price constant)
- $Y < Y_E$
 - Producers want to produce more.
 - Since the economy operates lower than full-employment, $Y \uparrow$ and $\bar{P}$.
 - (Firms use idle capacity, willing to supply more without an increase in price)
 - Full “Multiplier effect” (same size as discussed in Ch. 3)
- $Y > Y_F$: same as Classical School

3.3 Non-Keynes, Non-Classics

- Economy does not have to operate at full-employment all the time (same as Keynes)
- The difference from Keynes
 - Before full-employment $Y < Y_F$, the SRAS curve will be upward sloping from left to right.
 - When the economy operates far from full-employment, if there is any increase in production, cost will **gradually** rise.
 - But once the economy approaches the full-employment, the increase in cost of production can be quite **rapid**.
 - At full-employment, AS will be vertical (same as classics).

1. AD-AS : Non-Classic, Non-Keynes

- Autonomous expenditure $\uparrow \Rightarrow$ AD shift to the right

- $Y < Y_F$

- If there is any $\uparrow$ in production, cost will **gradually** rise.
- Law of diminishing returns: produce $\uparrow$, average cost $\uparrow$
*See note
- The firms raise the price when supply more output
- $P \uparrow, Y \uparrow$
- **“Multiplier Effect” (smaller than Keynes’s case)**
- Both AD and AS jointly determine equilibrium P and equilibrium Y

- $Y > Y_F$: same as Classic

2. DAE Model : Autonomous expenditure $\uparrow$

- $Y < Y_E$:
 - DAE shift to the right from DAE_1 to DAE_2 (keeping price constant)
 - To supply more output, firms raise the price
 - $P \uparrow$, $DAE \downarrow$ (DAE shift down) from DAE_2 to DAE_3
 - $AD \uparrow \Rightarrow P \uparrow$, $Y \uparrow$ from Y_1 to Y_3
 - There is “**Multiplier effect**” (smaller size than Keynes's)
- $Y > Y_F$: same as Classic

- Note: Law of diminishing marginal returns
- Production Function : $Q = f(K, L)$, where Q is quantity produced, K is capital and L is labour
- Law of diminishing marginal returns
 - fixed K , as $L \uparrow$, $MP_L \downarrow$
- Therefore, in SR, firm is forced to use existing production capacity, for example same size of plant. The production is then subjected to law of diminishing returns. When more outputs are needed to be produced, average cost (AC) will rise.
- When more outputs are needed to be produced, firm might employed existing workers to work longer $\rightarrow$ they have to be paid overtime $\rightarrow$ the cost will be higher so as to the price level.

- Compare the effect of an equal increase in autonomous expenditure. What would happen to Y_E , from the three schools's point of view?
- At $Y \geq Y_F$: there is no distinction among the 3 schools because if the economy operates at Y_F , there is a change in AD, output cannot be changed. There is no output effect. The only thing that would change would be the price level.
- At $Y < Y_F$: the multiplier effect of the 3 schools are different
 - Classical school : there is no multiplier effect.
 - Keynesian school : multiplier is greater than non-Keynes, non-classics

$$\text{multiplier} = \frac{\Delta Y_E}{\Delta \text{Autonomous Expenditure}} = \frac{1}{\underbrace{1 - \text{slope of DAE}}_{\text{marginal propensity to spend}}}$$

we are considering the same $\Delta \text{Autonomous Expenditure}$
 Note that multiplier for Keynes is greater than the multiplier for non-Keynes, non-Classics.

- Keynesian multipliers are greater than Non-Keynes, Non-Classics? Do you agree or disagree?
- What are Similarities and Differences between Keynes and Non-Keynes?
- What determines the size of multiplier?
 - The slope of DAE, the greater the slope of DAE, other things remain the same, the greater the multipliers.
 - The slope of DAE is determined by the induced expenditure and income tax.
 - MPC, MPI, MPM (marginal propensity to import), income tax rate (t)
 - The greater MPC, MPI $\Rightarrow$ the greater the slope of DAE and the greater the multiplier
 - the lower t , MPM $\Rightarrow$ the lower the slope of DAE and the lower the multiplier

Multiplier

$I = I_a$ $T = T_a$	$I = I_a$ $T = T_a + t.Y$	$I = I_a + dY$ $T = T_a$	$I = I_a + dY$ $T = T_a + t.Y$
Closed Economy			
$\frac{1}{1-b}$	$\frac{1}{1-b+bt}$	$\frac{1}{1-b-d}$	$\frac{1}{1-b+bt-d}$
Open Economy			
$\frac{1}{1-b+m}$	$\frac{1}{1-b+bt+m}$	$\frac{1}{1-b-d+m}$	$\frac{1}{1-b+bt-d+m}$

- If $\underbrace{m, t}_{\text{Leakage}} \uparrow$, slope of DAE $\downarrow$, multiplier $\left(= \frac{1}{1 - \text{slope}} \right) \downarrow$
- If $\underbrace{b, d}_{\text{Injection}} \uparrow$, slope of DAE $\uparrow$, multiplier $\left(= \frac{1}{1 - \text{slope}} \right) \uparrow$

Keynes	Economy operates lower than full employment level When DAE changes, price doesn't change
Classic	Economy operates at full employment level When DAE changes, price changes
Non-Keynes, Non-Classic	Economy operates lower than full employment level When DAE changes, price changes